

REMARKS

The present amendment is prepared in accordance with the new revised requirements of 37 C.F.R. § 1.121. A complete listing of all the claims in the application is shown above showing the status of each claim. For current amendments, inserted material is underlined and deleted material has a line therethrough.

Applicants appreciate the thoroughness with which the Examiner has examined the above-identified application. Reconsideration is requested in view of the remarks below.

Claims 19, 29, and 30 have been canceled. Claims 1-18 and 20-28 are pending in the application.

Applicants note that the objections to the Abstract and Title have been withdrawn. Also, the rejection under 35 USC §112, second paragraph has been withdrawn.

The only remaining rejections are under 35 USC §103.

Claims 1-6, 8-9, 11-18, and 21-24 have been rejected under 35 USC § 103(a) as being unpatentable over Berbel (U.S. Patent No. 5,989,354) or Matthews (U.S. Patent No. 5,911,837).

Berbel is cited as teaching a method for drying objects. The method comprises at least two fluids of different densities so that a fluid interface exists between each fluid, providing the article, positioning the article into one of the at least two fluids, and passing the article through at least one fluid interface vertically. The Examiner cites the Abstract, column 2, line 58 - column 3, line 48, column 4, lines 21-60, column 6, lines 14-56 and the claims. Berbel teaches that the volatile second fluid is pumped into the container from beneath the first fluid thereby scrubbing the object of the first and second fluids as the

second fluid pushes the first fluid to the exit. The Examiner cites column 3, lines 17-21. The Examiner also notes that the references teaches that the object 46, when introduced along path 60, first is washed by first fluid 48, then by volatile second fluid 50 until it is removed from container 12, citing column 4, lines 52-60. The reference is cited as also teaching removing the particles that adhere to the surface, citing column 6, lines 48-56.

Matthews is cited as teaching a process for removing organic materials from semiconductor wafers and a process for drying the wafers. The reference teaches providing two fluids of different densities, the interface, passing the article through the at least one fluid interface vertically, and drying the wafer. The reference teaches using an organic solvent such as ether or ketones. See column 15, lines 7, column 16, line 48.

The Examiner notes that Berbel and Matthews do not disclose removing contaminants from the surface of an article as claimed. However, the Examiner contends it would have been obvious to one skilled in the art to use the processes taught by Berbel and Matthews to remove the contaminants from an article surface because the processes taught by Berbel and Matthews are functionally equivalent to the process as claimed. This is considered so because scrubbing the article as taught by Berbel and removing the water including the residues as taught by Matthews are functionally equivalent to removing the contaminants from an article surface as claimed.

Applicants' invention as now defined is directed to a method of removing contaminant particles from an article surface wherein at least two fluids of different densities are used such that a fluid interface exists between each fluid. An article is provided where one or more contaminant particles are on the surface of the article which

particles have a greater affinity or solubility to one of the fluids. The article is positioned in one of the fluids and then the article is treated to move the contaminant particles by passing the article through the fluid interface.

All the claims are directed to a method and all the claims require that a fluid interface exist between the fluids to where the article passes to remove the contaminant particles from the article surface. It is respectfully submitted that the prior art references do not show Applicants' invention whether taken singly or in any proper combination thereof. It is further respectfully submitted that Applicants' invention is proper under prevailing Patent Law as discussed below.

The Berbel reference is directed to a method of drying objects with fluids. This can be seen from the title, abstract, text and claims. There is no disclosure in Berbel to remove contaminants on the surface using two fluids, one of which has a greater affinity or solubility for the contaminant as claimed by Applicants. Berbel is directed to the drying of objects.

The Matthews reference discloses (1) a process for removing organic materials from semiconductor wafers and (2) a process for chemical solvent drying of wafers. In the drying process, a wafer is submerged in a bath having a lower aqueous layer and an upper organic layer and is lifted from the lower aqueous layer up through the upper organic layer and removed from the bath. Such a procedure is shown in Fig. 4.

The Matthews reference also discloses a process for removing organic materials from semiconductor wafers. In this process the apparatus shown in Fig. 1 is used in which tank 13 holds the fluid to be used to treat semiconductor wafers. The fluid is continuously

recycled through the tank during which a gas is injected into the tank at 5, which is connected to the bottom of the tank. This process for removing organic materials require diffusing a gas through a fluid in which the semiconductor wafer is held. It is not Applicants' method of holding a semiconductor wafer in a fluid and then passing the wafer through a fluid interface into another fluid.

It should be appreciated that the Matthews reference actually teaches away from Applicants' invention because it discloses a method of removing organic materials from semiconductor wafers which requires a gas being passed through a fluid which holds the wafer. Once the wafer has been cleaned it may be dried by using the process of a fluid interface. Accordingly, Matthews teaches away from Applicants' invention and merely discloses a drying method whereby a semiconductor wafer is moved through a fluid interface.

The Examiner concludes it would have been obvious to one of skill in the art to use the process as taught by Berbel or Matthews to remove the contaminants from an article surface because the processes taught by Berbel and Matthews are functionally equivalent to the process as claimed.

In the "Response to Arguments" the Examiner states that removing organic material from semiconductor wafers and drying objects by removing liquid particles from a surface are functionally equivalent to removing particles from the substrate surface because removing liquid from the surface will include removing any residues with the liquid from said surface. This conclusion is respectfully submitted to be technically erroneous because volatilization of a fluid (drying) containing a particle will not "volatilize" the particle and

the particle will remain on the surface. This is the problem caused by "cleaning by drying." It can't be done. The particles must be removed and this is accomplished in the Applicant's method of using the interface.

Applicants would like to reiterate that as the Court of Customs and Patent Appeals pointed out in *In re Spormann*, (CCPA 1966) 150 USPQ 449: "The inherency of the advantage and its obviousness are entirely different questions. That which may be inherent is not necessarily known. Obviousness cannot be predicted on what is unknown." Further, a view that success would be inherent is not a substitute for showing a reasonable expectation of success. *In re Rinehart* (CCPA 1976) 189 USPQ 143. Expected beneficial results are evidence of obviousness just as unexpected beneficial results are evidence of unobviousness. *In re Skoll* (CCPA 1975) 187 USPQ 481. It is established law that a result not suggested by the prior art can impart patentability to a process whose manipulative steps are within the skill of the art. *In re Kaplan* (CCPA 1940) 45 USPQ 175. Where, as here, the Matthews reference teaches two methods, one for removing organic materials from a semiconductor wafer and the other process for chemical solvent drying of wafers, which are completely different processes, it is clear that Matthews is teaching away from Applicants' invention. Accordingly, the prior art discourages research in the very field in which the invention was made and discovering a method in the face of such prior art which suggests that such a method would produce unacceptable results is the antithesis of obviousness. *In re Rosenberger et al.* (CCPA 1967) 156 USPQ 24.

To summarize, Berbel teaches a method for drying objects with fluids and Matthews also teaches a method for drying objects with fluids. The Matthews reference further discloses a method for removing contaminants from semiconductor wafer surfaces using a fluid to hold the wafer and then passes a gas through the fluid to remove the contaminant from the surface. It is respectfully submitted in view of the deficiencies of the prior art and the Patent Law in this area that Applicants' claimed method is patentable over the references whether taken singly or in any proper combination thereof.

Claims 7, 10, 20, and 25-28 have been rejected under 35 USC 103(a) as being unpatentable over Berbel and Matthews as applied to the claims above, and further in view of Li and Squires et al.

At the outset, Applicants would like to point out that neither Berbel or Matthews refers to etching of wafers and this is acknowledged by the Examiner. Further the secondary references, which show etching, do not use a fluid interface as employed by Applicant.

Li is cited as teaching a method and composition for cleaning silicon wafers in a two-phase liquid system, citing the abstract. Li teaches the etching, the at least two fluids of different densities, using nonpolar organic liquids which include ethers, ketones and alkenes, citing column 3, lines 10-67, and columns 4-6, and the claims.

The Examiner concludes it would have been obvious to one skilled in the art to use the etchants that are taught by Li in the process that is taught by Berbel and Matthews to obtain the claimed process. This is because it is well known in the art to use etchants to remove contaminants from the surface of an article.

Squires et al. is cited to teach a method for stripping organic coatings from substrates. The reference teaches the two-phase liquids and agitation as claimed. The Examiner concludes it would have been obvious to one skilled in the art to use the agitation as taught by Squires et al. in a process taught by Berbel and Matthews to improve the removing process. This is because using the agitation will enhance the cleaning or removing process. It is respectfully submitted that the claims are properly allowable over this combination of references.

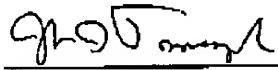
The Li reference discloses a method and composition for cleaning oxides and metals on surfaces of silicon wafers in a two-phase liquid system. However, and as acknowledged by the Examiner, Li does not teach passing the article through at least one fluid interface as claimed by Applicants. The silicon wafer is merely maintained in the upper non-polar organic liquid etchant phase and metal ions are transported from the surface of the silicon wafers in the organic top layer to the polar bottom layer by diffusion. **There is no movement of the wafer between the phase interface of Li. This is an important feature of Applicants' invention which is not shown in Li.**

Similarly, Squires et al. is directed to a di-phase stripping bath but the patent requires that it is essential to maintain a good dispersion of solvent phase and the aqueous phase during the time the coated substrate is in contact with the stripping bath. There is no two-phase bath through which interface the wafer or other articles pass to remove contaminant particles from the surface of the article. On the contrary, Squires et al. requires that two-phase liquid bath be agitated to maintain the uniform dispersion of the organic phase and the aqueous phase.

In summary, it is respectfully submitted that the references do not disclose nor teach Applicants' invention but actually teach away from Applicants' invention. Thus, the primary references merely show the drying of semiconductor wafers and do not show the use of an etchant phase to etch the wafer and then terminating etching and removing particles by passing the etched wafer through the interface. The secondary reference to Li does not even pass the wafer or other article through a phase boundary layer which is an essential feature of Applicants' invention. Squires et al. requires that two fluid phases be dispersed to provide significantly improved effectiveness to remove a wide variety of organic coatings from substrates.

It is respectfully submitted that the application has now been brought into a condition where allowance of the case is proper. Reconsideration and issuance of a Notice of Allowance are respectfully solicited. Should the Examiner not find the claims to be allowable, Applicants' attorney respectfully requests that the Examiner call the undersigned to clarify any issue and/or to place the case in condition for allowance.

Respectfully submitted,


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